MEMORANDUM

INTERMOUNTAIN POWER SERVICE CORPORATION

TO: George W. Cross

FROM: Dennis K. Killian

DATE: January 27, 2005

SUBJECT: Suggestions for Improving Dust Collector Operation and Maintenance

We have completed the dust collector survey and recommend the following to improve dust collector operation and maintenance:

1. Add an additional differential pressure switch to the controls for high differential pressure alarm. The existing two switches should be used to start and stop the cleaning cycle only. Estimated cost, $500 per collector.

2. Balance the dust collector total air flow and air flow to each pick-up point. Weld all dampers in the correct location so that they cannot be changed.

3. Seal all locations where water can leak into the systems and reduce the amount of runtime during wash downs.

4. Prepare a written procedure for dust collector troubleshooting that can be used by Operations to resolve high differential problems without replacing the bags.

If these suggestions fail to reduce the differential pressure to acceptable levels, the following more extreme courses of action can be taken.

1. Install pleated bags to reduce the air to cloth ratio as needed. Cost varies with the size of the collector.

2. Install internal baffles to direct the coal dust down into the hopper instead of directly impinging on the bags.

Revise Cleaning Controls

The current system uses a dual set point differential pressure switch to provide all control and alarming functions. The set points can be adjusted from the control panel by turning two

knobs located on the differential pressure gauge. The high

pressure setting initiates the cleaning cycle and the low pressure setting turns off the cleaning cycle. The high pressure setting also initiates a "High Differential Pressure" alarm if it does not clear after the cleaning cycle is in service for more than two minutes. The initial design settings were six inches of water to initiate the cleaning cycle and four inches of water to turn it off.

Unfortunately, some personnel have learned that the high differential pressure alarm can be cleared by simply adjusting the upper set point using the knobs provided on the control panel and we have often found the needle at the highest possible setting. This means the cleaning cycle does not initiate until the bags are blinded and the differential pressure has driven the dust into the fabric. We have no problem with a high setting for the differential pressure alarm (approximately 10 inches of water), but the cleaning cycle should initiate at the design settings. We believe this change will greatly reduce the number of high differential pressure alarms.

Upon your approval, we will work with I&C to make this change as quickly as possible.

Balance the Systems

The following table shows the current air flows to each dust collector.

Table 1: Air Flow Survey

DC	Photohelic Set Point		A/C ratio		Air flow rate, CFM		Comment
	Actual	Design	Actual	Design	Actual	Design	
1A - D	4.0/9.05	4.0/6.0	4.6:1	< 6.4:1	52,124	73,500	
4	4.0/9.5	4.0/6.0	3.9:1	< 6.4:1	20,496	34,000	
5	3.0/9.0	4.0/6.0	8.1:1	< 6.3:1	32,829	26,000	High A/C
6	5.0/8.0	4.0/6.0	7.4:1	< 6.3:1	20,069	17,500	High A/C
11	3.5/10.0	4.0/6.0	6.5:1	< 6.3:1	17,577	18,000	
13A		4.0/6.0		< 6.25:1		33,000	
13B	4.0/9.5	4.0/6.0	7.1:1	< 5.99:1	19,215	16,500	High A/C
14A	3.0/9.5	4.0/6.0	7.9:1	< 6.5:1	23,157	19,500	High A/C
14B	4.0/9.2	4.0/6.0	6.3:1	< 5.99:1	17,080	16,500	

As you can see, most of the dust collectors have lower than designed air flow but, some are significantly higher. Low air flow reduces the amount of dust collected at each pick point and reduces the differential pressure across the bags. High air flow

picks up more dust than needed and increases the differential pressure at the baghouse. We recommend that Maintenance contract with a testing firm to balance and set the dampers to provide the correct total and branch air flows and that the balancing dampers be welded so that they cannot easily be adjusted.

Seal Locations for Water Ingress

A recent inspection of the baghouses by a representative from BHA (see attached report) found many locations where water can leak into the dust collectors fouling the bags. Of particular concern were the doors at the top of the collectors where water can frequently pool. These areas should be sealed to prevent ingress. Laborers should be instructed to keep these areas as dry as possible.

Dust Collector Troubleshooting Guidelines

Maintenance has indicated that there have been times when they get work orders to fix high differential pressure, only to find that the cleaning air has been valved out or the set point changed. We believe that a checklist of corrective actions might be helpful for plant personnel to solve problems without generating work orders for Maintenance to schedule and resolve.

Pleated Bags and Baffles

In the event that the above changes do not reduce the differential pressure enough to get out of alarm, pleated bags are available that will increase the surface area of the cloth. This is much more economical than any other method of increasing the filter cloth area. BHA also recommends installing a baffle in some locations to direct the incoming air flow away from the cloth. Again, we recommend doing this only after the other modifications have proven to not completely solve the problem.

If you have any questions about these modifications please contact Phong Do at extension 6475.

_____ _____

George W. Cross
President and Chief Operations Officer

Date

PTD/JKH:jmj

Attachments

cc: Stan L. Smith
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December 2, 2004

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Attn: Phong Do

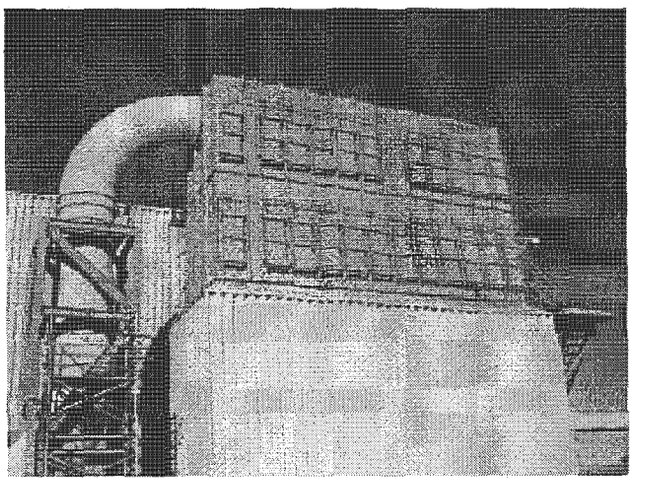
Ref.: BHA Technical Visit

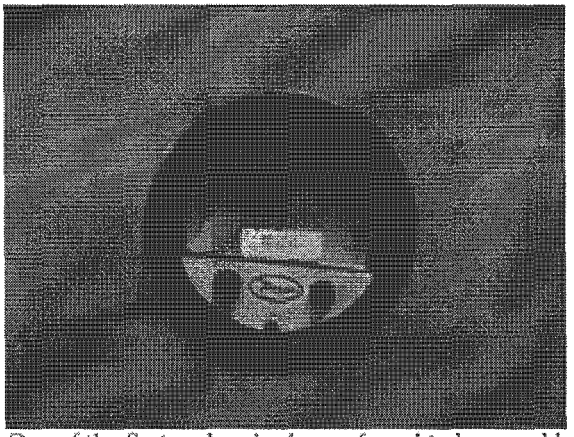
Dear Phong:

Thank you for your hospitality during my visit to your plant the week of December 1st.. The main purpose of the visit was to evaluate 8 of your coal handling dust collectors, which are having ventilation issues and bag life problems. The following is a summary of our observations and recommendations.

Attached you will find the Baghouse maintenance reports that give a glance look at the condition, settings, and airflow of the 8 units evaluated. Valuable information is found on these sheets showing the "As Found" condition of each unit inspected.

This portion of the report will simply talk about the issues and improvements that can be generally made. The comments will be made around pictures for ease of explanation.





One of the first and major issues found to be a problem was the differential set points for clean on demand capabilities.
In all cases, the set points were set very wide and generally on the high side.

As you can see in the above picture and on the attached sheets, the cleaning cycle will not start until it crosses over the upper set point at 10" DP H2O. This is very high differential pressure that creates a high vacuum across the filter media and reduces draft on the pickup points or process. In many cases the low set point is so low that it may never be able to clean down to the level and stop the cleaning cycle. This means that the baghouse will continually clean unnecessarily stripping the bags of the necessary dust cake.

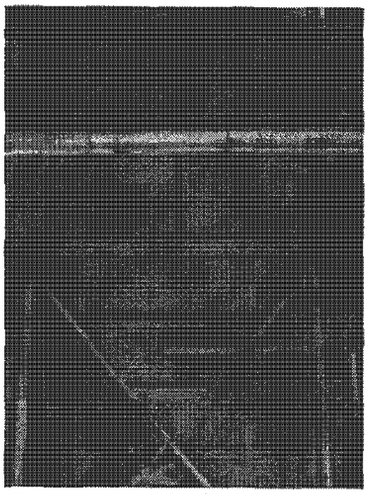
Other factors are that these set points create a large dump of material on the screw or rotary feeder often bringing about bridging and plugging.

The swings in DP make it impossible to balance a system with the slide gates at the pick up points. It insures varied draft and cannot be controlled well at all.

In short, these set points affect the system adversely upstream, downstream, and in the unit itself.

The set points should be brought in tight with a 1/2" window between them and set at 5.0" and 5.5".

Other options are to wire the lower needle to perform both start and stop of the cleaning cycle logic and use the upper needle for alarm.
You may also choose to use the PLC logic to set the points and control each unit using the analogue gauge as a DP reading gauge only.



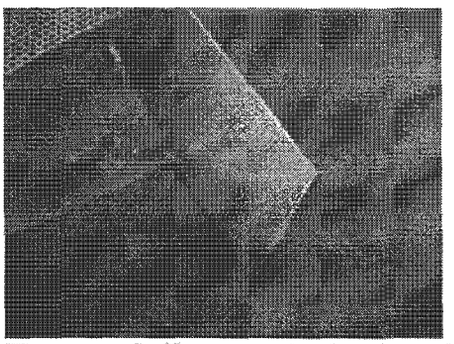
The pyramid hoppers are small in size and the inlet ducts are high in the hoppers. The airflow is entering the units at a high rate of speed and do not have time or area to slow down. It is important that the airflow slow down to agglomerate material for fall out as well as reduce the velocity to well below 400 FPM prior to hitting the can area of the bags.

Inlet, hopper, and baffle design play a big part in the airflow and abrasion each unit sees.

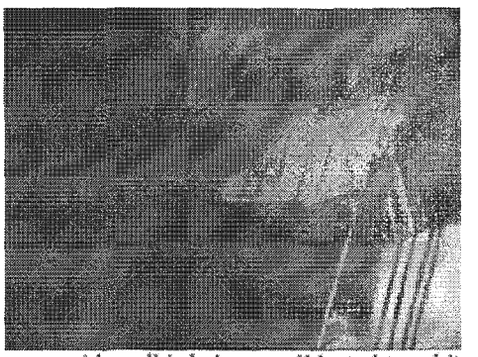
Unit 6 needs to have a baffle design change to better distribute the grain load as it changes airflow.

Hopper area can and should be increased by changing from bag and cage to Pulse-Pleats. You will realize an increase in filtration surface area while shortening the filter elements creating an area for slowing and drop out.

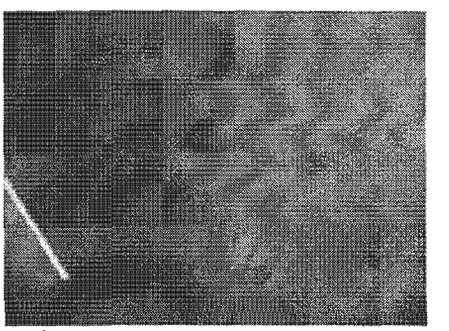
It is recommended that all of the pyramid hopper units be converted over to the BHA Pulse-Pleat units on their next change out.



The current baffles are made of perforated plate with an angled diverter plate at the end. This plate is directing airflow in a concentrated pattern rather than slowing and distributing the airflow and grain load.



In the above picture, the hopper sidewall is being sandblasted to white metal in the direction of the outlet damper. Filter bags in a specific area are being abraded with the high grain load and velocity. You can see in the above picture that the hopper sidewalls are white metal around an area of original red oxide primer that has been left.



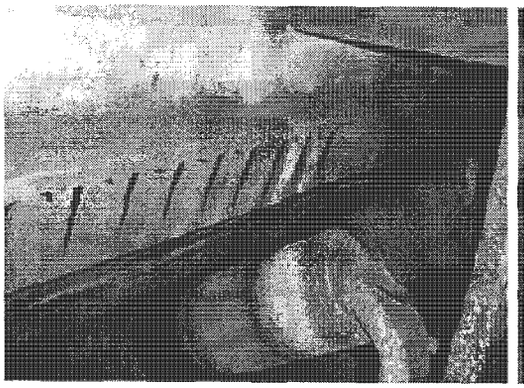
The result is reduced bag life and poor dust collector operation.

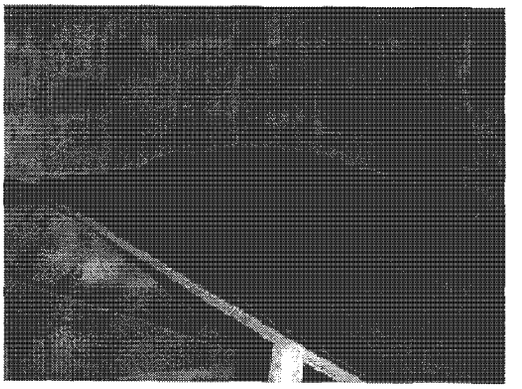
During the inspection it was noted that several of the units had doors that were leaking to atmosphere. These doors above are on the #4 unit. While standing on the unit you can hear the airflow leaking past the door seal. This pulls air from atmosphere through the clean air plenum rather than from the pickup points or process.

Another issue that appears to be prevalent is the washing down of the buildings with copious amounts of water. The water was everywhere in the buildings but most importantly it was being sucked into the units through the leaking doors.

Other areas of concern are too much water introduced at the pick up points. Remember that dust collectors are dry collection units. Water and dust make mud that is impermeable when attached to the surface of the filter media.

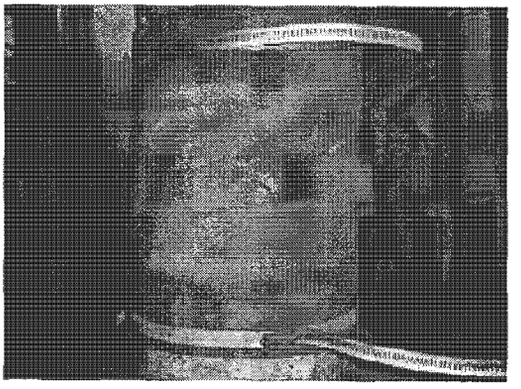
Doors and door gaskets need to be sealed as well as all pickup points.
Wash down water should be kept away from the pickup points and suction areas as much as possible.



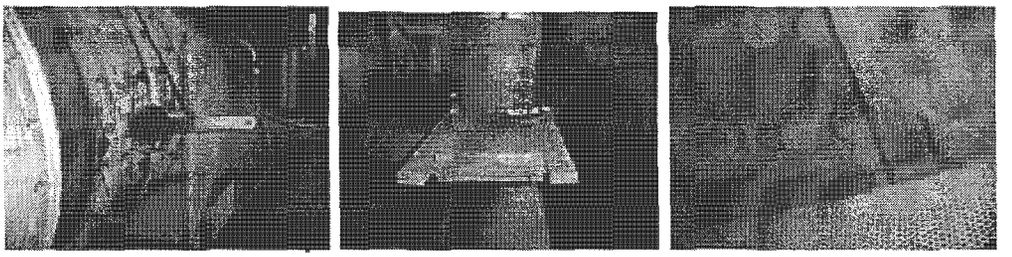


Belt conveyors and transfer points should be sealed up as much as possible.

In general, I found things to be sealed up fairly well. In the case of the picture on the left, the belt skirt board is missing requiring more vacuum to keep this area negative.



Expansion joints and piping should also be sealed to allow adjusted vacuum at the vent point and reduce moisture to the filters.



Each system needs to be balanced.

As mentioned in our on-site discussion, there are three effective dampers in each system.

1- ID Fan Damper
2- Slide gate or blast gates at pickup points
3- Filter bags and the dust cake or differential pressure maintained across them.

At this facility the fans are capable of more airflow than the design volume of the baghouse. Many of the units are pulling higher volumes than design.

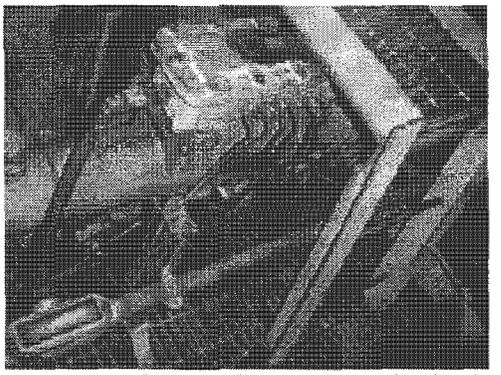
The differential pressure then needs to be stabilized by maintaining a baghouse DP of 5.0" +- ½". This will maintain a constant airflow across the baghouse.

Finally, the slide gates need to be balanced at each pickup point so as to keep the area or point negative without pulling product unnecessarily.

CLEANING CYCLE LOGIC:

Adjust to stagger cleaning cycle with two buffer rows between each cleaning row.

Output	Row
1	1
2	4
3	7
4	10
5	2
6	5
7	8
8	3
9	6
10	9



#10 row on the #6 unit is not firing the diaphragm. It may be an output, solenoid, or the diaphragm needing repair.

All rows should be in good working order. Not firing increases cake and is susceptible to combustion. It also reduced the overall air-to-cloth ratio pushing high loads to the remaining filter area.

SUMMARY:

- New Ladder-Vane baffle in #6 baghouse unit.
- Install BHA Pulse-Pleats in all single pyramid hopper units starting with #5 & #6.
- Install in-line separator and regulator prior to each manifold to reduce high cleaning pressure.
- Replace or repair door gaskets as needed and seal up all units to atmosphere.
- Balance all airflow systems. ID Fan Dampers - baghouse DP - Slide Gates.
- Create proper clean on demand set points.
- Install inline separator and regulator prior to each manifold to clean and reduce airflow, 80 to 90 psi on bag and cage - 65 psi on pulse pleats.
- Seal up all piping and pickup point areas.
- Educate through seminars maintenance and operations personnel on proper baghouse functionality.
- Adjust cleaning cycle logic or sequence to be staggered and identical to all units.

We are confident that this information will be very valuable in planning, budgeting and improving your ventilation systems. BHA appreciates the opportunity to work with the good people at IPP and look forward to helping you implement the recommended changes.

Coni Williams will provide you with applicable quotes under separate cover and will be contacting you soon to review this report. In the meantime, if you have questions or require additional information, you can contact us at 1 800 821 2222.

Sincerely,

BHA Group, Inc.

Reed C. Finch
BHA Consultant/Technical Advisor

cc: Coni Williams - Sales Representative, BHA Group, Inc.

Leyana S. Shelton ~ Project Management, BHA Group, Inc.